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# Hydronic Surface Heater

## S3000

**OPERATOR'S MANUAL**



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## Foreword

### Machines covered by this manual

This manual covers machines with the following item numbers:

Machine	Item Number
S3000	0620182
S3000G	0620218

### Machine documentation

- Keep a copy of the Operator's Manual with the machine at all times.
- Use the separate Parts Book supplied with the machine to order replacement parts.
- Refer to the separate Repair Manual (if available) for detailed instructions on servicing and repairing the machine.
- If you are missing any of these documents, please contact Wacker Neuson Corporation to order a replacement or visit [www.wackerneuson.com](http://www.wackerneuson.com).
- When ordering parts or requesting service information, be prepared to provide the machine model number, item number, revision number, and serial number.

### Expectations for information in this manual

- This manual provides information and procedures to safely operate and maintain the above Wacker Neuson model(s). For your own safety and to reduce the risk of injury, carefully read, understand, and observe all instructions described in this manual.
- Wacker Neuson Corporation expressly reserves the right to make technical modifications, even without notice, which improve the performance or safety standards of its machines.
- The information contained in this manual is based on machines manufactured up until the time of publication. Wacker Neuson Corporation reserves the right to change any portion of this information without notice.

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### CALIFORNIA Proposition 65 Warning:

Engine exhaust, some of its constituents, and certain vehicle components, contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

### Laws pertaining to spark arresters

**NOTICE:** State Health Safety Codes and Public Resources Codes specify that in certain locations spark arresters be used on internal combustion engines that use hydrocarbon fuels. A spark arrester is a device designed to prevent accidental discharge of sparks or flames from the engine exhaust. Spark arresters are qualified and rated by the United States Forest Service for this purpose. In order to

## Foreword

comply with local laws regarding spark arresters, consult the engine distributor or the local Health and Safety Administrator.

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# S3000 OPERATOR'S MANUAL – LIST OF ABBREVIATIONS

## LIST OF ABBREVIATIONS

The following is a list of abbreviations used throughout the Operator's Manual:

<u>Abbreviation/Symbol</u>	<u>Term/Meaning</u>
<b>amp.</b>	<b>ampere</b> (measurement of electrical current)
<b>asl</b>	<b>above sea level</b>
<b>BTU</b>	<b>British Thermal Unit</b> (measurement of heat energy)
<b>°C</b>	<b>degrees Centigrade</b> (metric measurement of temperature)
<b>cm</b>	<b>centimeter</b> (1/100 <sup>th</sup> of a meter)
<b>°F</b>	<b>degrees Fahrenheit</b> (measurement of temperature)
<b>ft</b>	<b>foot/feet</b> (measurement of length/distance)
<b>ft<sup>2</sup></b>	<b>square foot/square feet</b> (measurement of area)
<b>ft-lbs</b>	<b>foot pounds</b> (measurement of torque)
<b>gph</b>	<b>gallons per hour</b> (measurement of liquid flow)
<b>GFI</b>	<b>Ground Fault Interrupt/interrupter</b> (protection device)
<b>GHI</b>	<b>Ground Heaters, Incorporated</b>
<b>GVWR</b>	<b>Gross Vehicle Weight Rating</b>
<b>HHS</b>	Ground Heaters <b>Hose Handling System</b>
<b>HTF</b>	Ground Heaters <b>Heat Transfer Fluid</b>
<b>HTH</b>	Ground Heaters <b>Heat Transfer Hose</b>
<b>hr</b>	<b>hour</b> (measurement of time)
<b>Hz</b>	<b>Hertz</b> (measurement of frequency)
<b>ID</b>	measurement of <b>Inner Diameter</b>
<b>in.</b>	<b>inch/inches</b> (measurement of length/distance)
<b>kg</b>	<b>kilogram</b> (metric measurement of weight)
<b>Kilo-Cal</b>	<b>Kilo-Calorie</b> = 1000 Calories (metric measurement of heat energy)
<b>kPa</b>	<b>kilo-Pascals</b> (metric measurement of pressure)
<b>kW</b>	<b>kilo-Watt</b> (measurement of electrical power)
<b>lb</b>	<b>pound</b> (measurement of weight)
<b>m</b>	<b>meter</b> (metric measurement of length/distance)
<b>mm</b>	<b>millimeter</b> (1/1000 <sup>th</sup> of a meter)
<b>psig</b>	<b>pounds per square inch gauge</b> (measurement of pressure)
<b>Rev.</b>	<b>Revision</b>
<b>TC</b>	<b>Temperature Controller</b>
<b>USDOT</b>	<b>United States Department of Transportation</b>
<b>V.</b>	<b>Version</b>
<b>VAC</b>	<b>Volts, Alternating Current</b>
<b>VDC</b>	<b>Volts, Direct Current</b>





## INTRODUCTION

The Model S3000 Ground Heater thaws frozen ground, cures concrete at ambient temperatures below 40°F (5°C), heats cold ground and provides temporary heat during construction. Ground Heaters, Inc.'s revolutionary technology enables construction activities to continue throughout the cold weather months.

The S3000 Ground Heater is equipped with 3,000 ft (915 m) of 5/8 in. (16 mm) ID Ground Heaters Heat Transfer Hose (HTH). The HTH radiates and conducts heat directly to the application area. The diesel-fired burner heats the Ground Heaters Heat Transfer Fluid (HTF) to 180°F (82°C). The HTF is continuously circulated through the HTH in a vented, closed-loop system.

With standard equipment, the S3000 will:

- Thaw up to 4,500 ft<sup>2</sup> (418 m<sup>2</sup>) of frozen ground per application using 18 in. (45 cm) spacing.
- Cure all types of concrete placements, including slabs on grade, elevated slabs, tilt-up walls, poured walls, columns, footings, bridge decks, etc. up to 6,000 ft<sup>2</sup> (560 m<sup>2</sup>) per application using 24 in. (60 cm) spacing.
- Provide direct hydronic heat to any surface that the HTH is applied, i.e. to heat water tanks, warm aggregate; de-ice roofs and countless other temporary heating applications.

### 1.1 EXTERNAL FEATURES (Photo 1-1)

1. Adjustable ball or pintle style hitch (not shown)
2. Tie-Downs on frame for air/crane lifting or transport securing
3. Optional lifting bar for air/crane lifting
4. 178 gallon (674 liter) Fuel Tank for extended operation
5. Fuel filling cap
6. Optional air cooled genset or liquid cooled Onan/Kubota generator

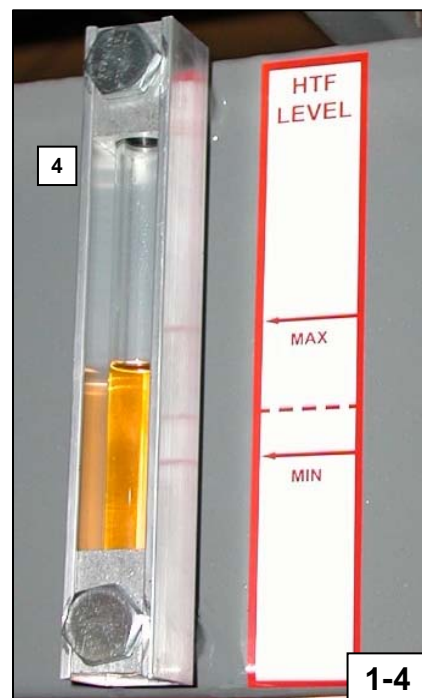
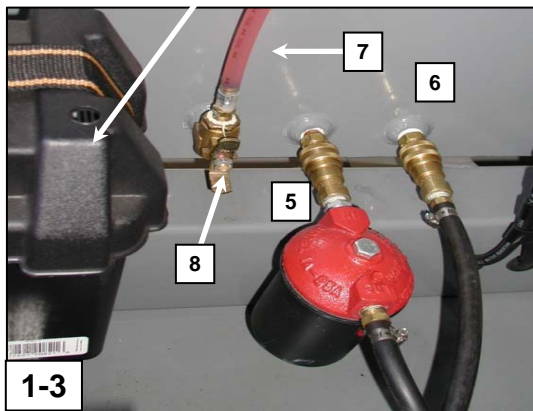
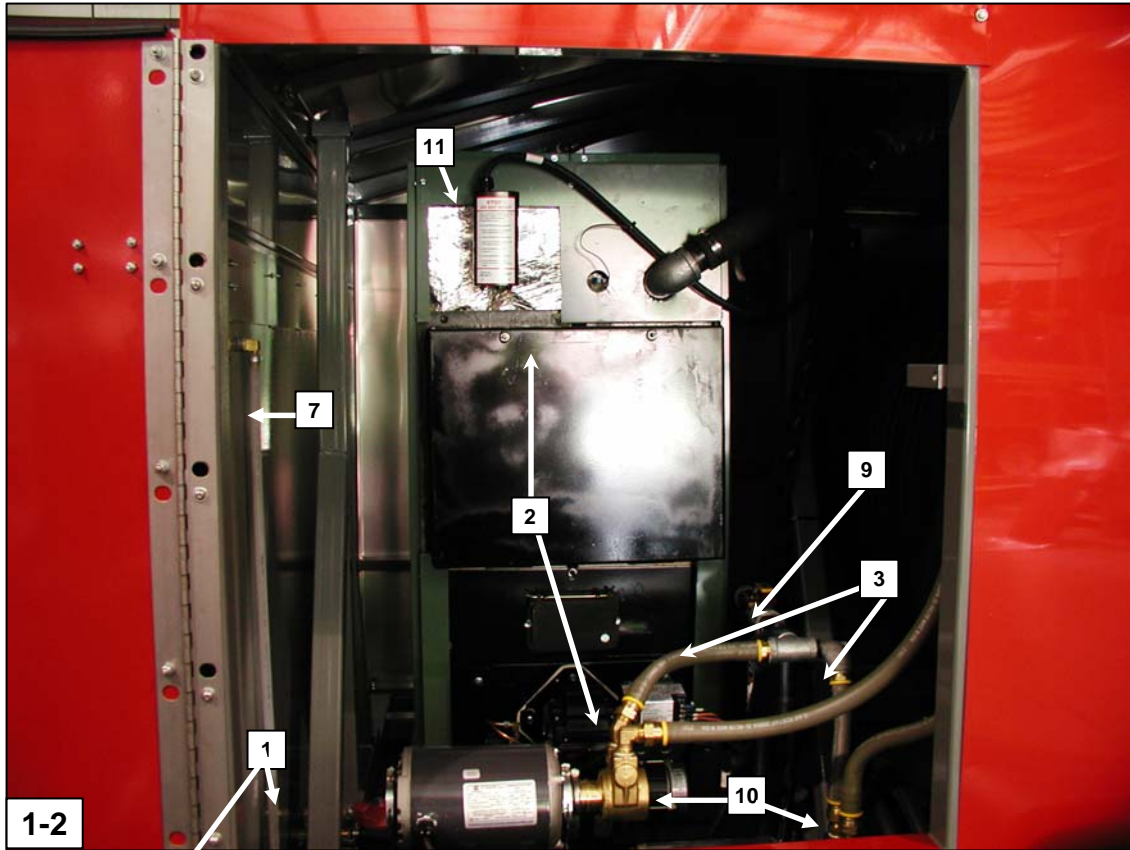


1-1

## 1.2 INTERNAL COMPONENTS

1.2.1 The following components are accessed via the side door: (Photos 1-2 to 1-4)

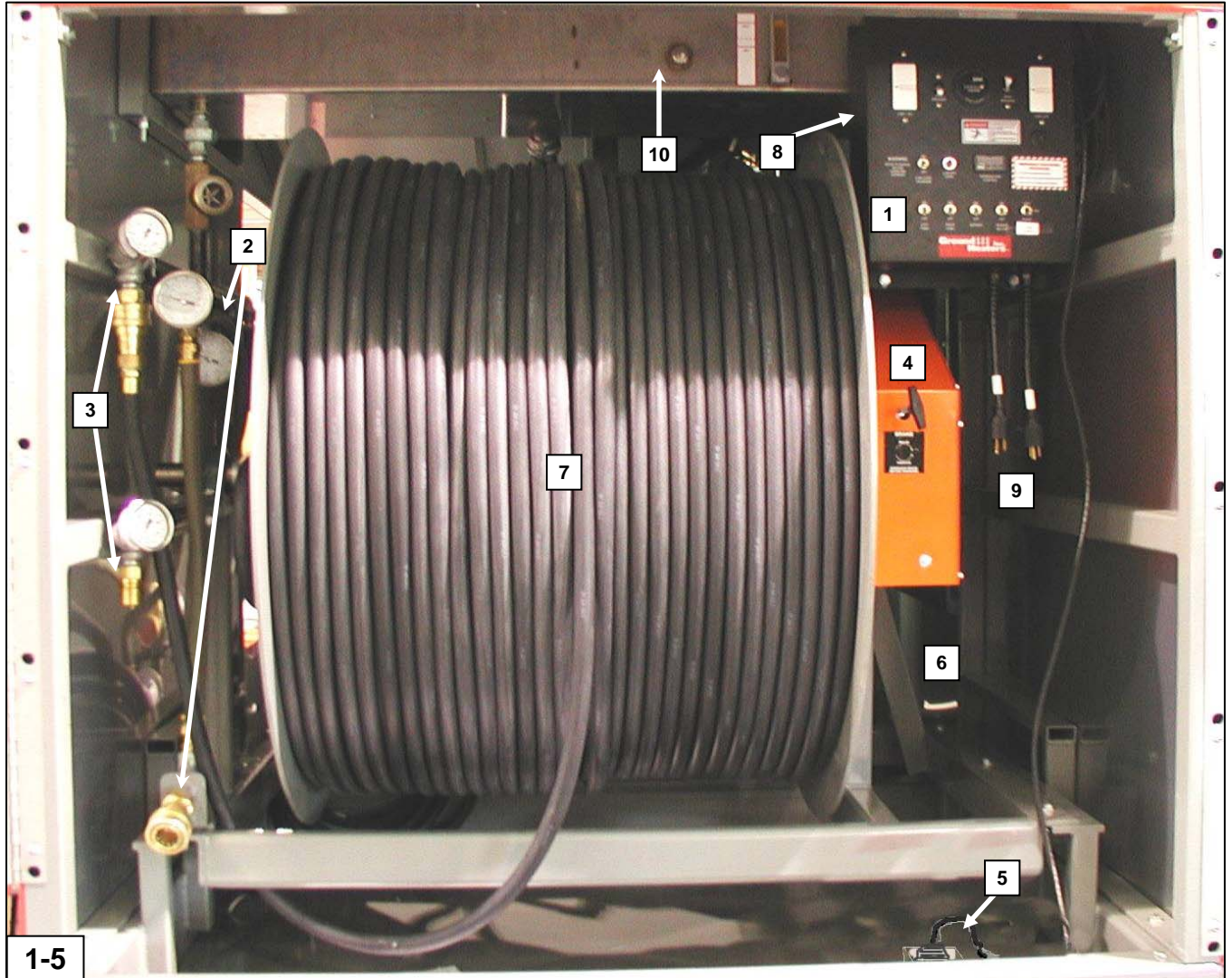
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|-----------------------------------|----------------------------------|--|
| 1. Genset 12-volt Battery         | 5. Fuel Filter and Quick-Connect | 9. HTF Fill Valve                            |
| 2. Burner and Hydronic Heater     | 6. Fuel Return Line              | 10. HTF Pumps                                |
| 3. HTF Pump Suction Plumbing      | 7. Fuel Sight Gauge              | 11. Low HTF Level Shutdown with Manual Reset |
| 4. Expansion Tank HTF Sight Gauge | 8. Fuel Sight Gauge Valve        |  |





1.2.2 The following components are located inside the rear door: (Photo 1-5 and 1-6)

- |   |   |
|---|---|
| 1. Control Panel                        | 6. Operator's Manual                          |
| 2. Return Plumbing                      | 7. Hose Reel with two 1,500 ft (457 m) of HTH |
| 3. Supply Plumbing                      | 8. Rewind Motor (behind control panel)        |
| 4. Hose Reel Brake Operating Knob       | 9. Main Power Pigtail Connections             |
| 5. Foot Pedal for Rewind System Control | 10. Expansion Tank                            |



### 1.3 SAFETY FEATURES

S3000 Ground Heaters are safe, quality equipment. S3000 Ground Heaters are USDOT compliant, meet all state requirements, and meet all Transport Canada requirements.

Specific safety features include:

1. Trailer Brakes: electric with breakaway switch (12 VDC).
2. Hydronic Heater: operates at zero (atmospheric) pressure.
3. Low HTF Level Shutdown: turns off the burner and pumps if HTF level in the system drops below minimum operating level. Manual reset requirement prevents unsupervised pump/burner start up.
4. System Overpressure Protection: HTF pumps feature an internal pressure relief valve that begins to open at 125 psig (860 kPa) and is fully open at 175 psig (1,200 kPa).
5. Ground Fault Interrupters (GFI): built into control panel to protect operators.
6. Circuit Overload Protection: built into control panel to protect all components.
7. Burner Flameout Protection: Primary Controller uses optic flame sensor to turn off burner if burner fails to ignite or upon loss of flame for 15 seconds. Manual reset requirement prevents unsupervised restart.
8. Pump Motor Overload Protection: internal thermal overload trip with automatic reset.
9. Burner Motor Overload Protection: internal thermal overload trip with manual reset.
10. Reflective Markers: enhance night identification.
11. Foot Pedal: for rewind system wired with low voltage (12 VDC) signal to protect personnel from shock hazard should the foot pedal become accidentally immersed in water.
12. Digital Temperature Controller: fails safe (Burner Off) upon loss of power or temperature sensor malfunction.

### 1.4 SAFETY PRECAUTIONS

Ground Heaters, Inc. develops and manufactures equipment that is safe to operate. However, an accident could occur if the S3000 Ground Heater is used improperly. Safe operation requires that all instructions and precautions be followed. Key safety precautions are posted with decals throughout the machine. Read and understand all material in this Operator's Manual and on the decals posted on the S3000 before attempting to operate it.

#### 1.4.1 Operators

There are no published standards or certification requirements for operating portable hydronic heating machines. The following criteria reflect the experience of Ground Heaters, Inc. and should be considered a guide, not a comprehensive requirement. The following operator characteristics will prevent accidents, facilitate satisfactory results, and ensure reliable service from the S3000:

1. Patience: Insures the system runs at optimum levels; the machine is level and secure; leaks are found and fixed; valves are properly set; and switches are activated properly.
2. Good Hearing, Vision and Smell: Enable operator to assess equipment and detect potential malfunctions.
3. Self Respect: Dresses for the weather; wears eye protection and gloves; and does not take chances with personal safety. Do not operate the S3000 while intoxicated or impaired by alcohol or other substances.
4. Careful and Responsible: Insures the machine is operating properly before leaving it unattended; keeps track of fluid levels; locks compartments; conducts operational checks at regular intervals; and ensures proper officials are notified of the machine's use.
5. Above all, a Ground Heater operator reads and understands this Operator's Manual and the decals posted on the machine.



**Failure to adhere to all SAFETY PRECAUTIONS and recommendations may result in damage to the Ground Heater, damage to other property, personal injury, or possibly death.**

#### 1.4.2 Safe Operation and Maintenance

1. Read and understand all material in this Operator's Manual and on the decals posted on the S3000 before attempting to operate it.
2. Keep unauthorized people, especially children, away from the S3000.
3. Keep guards in place. Do not disable safety features.
4. Keep safety and instruction decals clean and legible. Replace damaged decals.
5. Do not operate the burner while the S3000 is in an enclosed, non-ventilated area. The burner exhaust contains carbon monoxide, an odorless and deadly poisonous gas.
6. Locate the S3000 on firm/level ground and chock wheels before operating.



**The S3000 Ground Heater is not designed to be operated during transit. Do not operate the S3000 while it is being towed or carried by truck.**

7. Switch the burner OFF during fueling operations.
8. Do not smoke while refueling. Do not refuel near open flame or sparks.
9. Clean up fuel spills immediately.
10. Do not transport people in or on the S3000.
11. If the S3000 starts to function improperly, turn off immediately and repair before restarting.
12. Always wear gloves when handling hot or cold components—especially the HTH. Never loosen or remove internal hoses or HTH while a pump or the heater is running or when the HTF temperature is above 120°F (49°C).

**NOTE: All hose fittings have been assembled with a drop of Loctite blue. If fittings are loosened, re-assemble with Loctite blue or equivalent. Internal hoses are self-locking on special hose barbs and do not require crimps or clamps.**

13. Do not attempt tire repairs. Have a qualified tire dealer or repair service perform required tire maintenance.
14. Torque for wheel lug nuts should be set at 100 ft-lbs.



**Failure to observe these warnings may result in injury or death.**

#### 1.5 REPAIR PARTS AND ACCESSORIES

Your Ground Heaters Distributor carries a complete line of parts and accessories needed for all repair or replacement requirements.

**1.6 MAINTENANCE**

All maintenance, with exception to routine lubrication and cleaning, should be performed by a qualified service technician using the Ground Heaters Service Manual.

The following preventative maintenance should be performed once per year, or every 1,500 hours, whichever comes first:

- Heater and Burner cleaning and inspection (refer to Section 3 of the Service Manual)
- HTF Filter cleaning (refer to Section 4, MAINTENANCE)
- Low Level Shutdown operation verification (refer to Section 2 of the Service Manual)
- Temperature Controller accuracy and operation verification (refer to Section 2 of the Service Manual)
- Routine Trailer Axle maintenance (common mechanical experience)

**1.7 OBTAINING WARRANTY SERVICE**

Your satisfaction is important to your Ground Heaters Distributor as well as to Ground Heaters, Inc. Warranty details are explained in the Ground Heaters, Inc. Statement of Warranty found on the reverse side of the Customer Delivery Checklist (located directly behind Operator's Manual cover sheet).

All warranty services must be completed by a certified Ground Heaters Distributor service technician. If your Distributor does not satisfactorily resolve the problem, please call Ground Heaters, Inc. at (231) 799-9600 for assistance. You will need to provide the following information for assistance:

- Name, address and phone number
- Machine serial number
- Date of purchase
- Distributor name and address (location)
- Nature of problem

Thank you for purchasing a Ground Heater. Both your Ground Heater Distributor and Ground Heaters, Inc. want to assist you in every way possible to ensure your complete satisfaction with your purchase.

## START UP, OPERATION AND SHUTDOWN

### 2.1 PRE-START UP CHECKS

#### 2.1.1 Positioning

1. Chock the wheels to prevent accidental rolling.
2. Use the trailer jack to position the machine as level as possible.

#### 2.1.2 Fuel and Heat Transfer Fluid

1. Open the side door.
2. Ensure there is sufficient fuel level in the fuel tank. Fuel sight gauge valve must be open to read actual tank level. (Photo 2-1)
3. Verify both the fuel supply and return quick-connects are connected to the fuel tank. (Photo 2-1)



**Failure to connect both fuel line quick-connects (supply and return) will result in fuel pump shaft seal failure when burner starts.**

4. Verify HTF level is between MIN and MAX in the sight gauge. (Photo 2-2)

**NOTE: If expansion tank fluid level is not above MIN level, refer to Section 4.1, ADDING HEAT TRANSFER FLUID, to correct before attempting to start the burner or HTF pumps.**

#### 2.1.3 Switch Positions

1. Open the rear door.
2. Verify LINE 1 and LINE 2 MAIN BREAKERS, PUMPS 1 and 2, BURNER AND REWIND MOTOR switches are in the OFF position on the control panel.

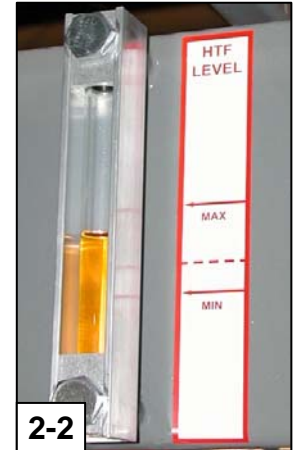
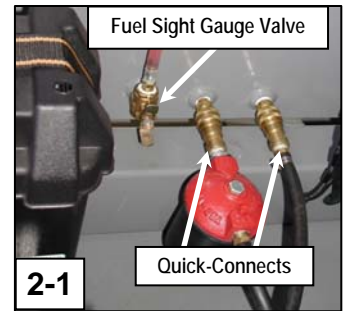
### 2.2 INITIAL POWER UP

- 2.2.1 Connect the control panel to two separate 120 VAC x 20 amp. services using the main power pigtail connections. Use only heavy-duty (10-3) power cords with a maximum length of 100 ft (30 m). (Photo 2-3)

**NOTE: Start optional Genset in accordance with Genset manufacturer's operating instructions, if so equipped. Plug Genset power cords into control panel pigtails.**

- 2.2.2 Turn ON the LINE 1 and LINE 2 MAIN BREAKERS and verify the following:

1. GFIs remain reset and amber indicator lights are off.
2. Interior light comes on.
3. LOW HTF LEVEL light goes on for 15 seconds and then turns off.
4. Temperature Controller (TC) shows actual heater temperature (in red) and heater set-point (in green).





## 2.3 S3000 START UP

### 2.3.1 Integrity Check

Verify all hose, fittings, and pipe connections are not leaking.

### 2.3.2 Warming the Heat Transfer Fluid

1. Use the UP/DOWN arrows to adjust the heater set-point on the TC to 70°F (21°C). (Photo 2-4)
2. Turn the control panel BURNER switch ON and verify the following:
  - a. The burner motor starts (after a 3 second delay) and fires 15 seconds later. If the burner fails to start, refer to Section 5, TROUBLESHOOTING.
  - b. Burner runs clean and quiet. The burner should run with no visible smoke. If burner operation is in question, a qualified oil-burner service technician should check burner air settings and emissions.

**NOTE:** Section 4.3, BURNER COMBUSTION VERIFICATION AND ADJUSTMENT, provides detailed instructions for testing burner emissions and resetting burner air settings.

### 2.3.3 Initiating Flow through Heat Transfer Hose

1. Position the following valves as directed below:
  - a. Verify fill valve #3 is locked shut and locking pin is inserted.
  - b. Open pump suction valve #2. (Photo 2-5)
2. Turn ON only PUMP 1 switch at the control panel to start circulating the HTF through both loops while on the hose reel. Verify indication of rising pressure on the HTF supply pressure gauge and flow indicator begins to turn.

**NOTE:** Never operate more than one pump while both hoses are connected in series. Never attempt using HTF hoses connected in series for any application other than warm-up.

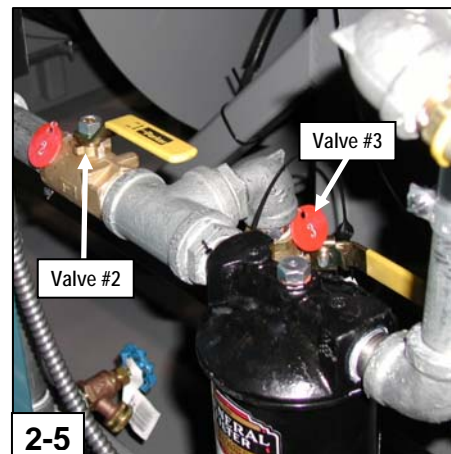
### 2.3.4 Unwinding Heat Transfer Hose for Application

1. Release the hose reel brake by turning it counterclockwise. (Photo 2-6)

**NOTE:** Adjust brake to allow sufficient drag on reel to prevent hose damage from over spinning.

2. Pull the Heat Transfer Hose (HTH) off the hose reel and place for thawing or curing at job site. The QC fittings joining loops 1 and 2 will be exposed when nearing the end of the first hose loop.
3. Once all of the first hose loop has been placed for thawing or curing, turn OFF PUMP 1, allow pressure to drop to 0 psi. Separate the two loops at the QC fittings. Connect the male end of hose loop 1 to female return QC fitting located on the bottom, left side of the hose reel.
4. Connect the female QC fitting of the second hose loop still on the reel to the male QC fitting on plumbing rack 2. Turn ON HTF PUMP 1 and 2; place the second hose for thawing and curing.
5. Set the TC to temperature required for application.

**NOTE:** Always set the TC to 180°F (82°C) for thawing applications to obtain best thaw rate. Concrete curing applications usually require temperature settings below 180°F (82°C).





## 2.4 MONITORING OPERATING PARAMETERS

The following parameters should be monitored every six to eight hours with applicable values written in the S3000 Operating Log. Use of the Operating Log will provide data to track trends and identify possible problems during troubleshooting:

1. Fuel Tank Level: Keep track of fuel consumption to plan needed filling schedule.
2. HTF Level: Normal expansion tank level should remain between MIN and MAX lines on the HTF sight gauge. (Photo 2-2)
3. HTF Return Temperature(s): Return temperature(s) will drop close to initial surface temperature. During a thaw application, return temperature will rise rapidly to approximately 100°F (38°C) during first 8 to 12 hours and rise slowly to 140° to 160°F (60° to 71°C) when thaw is complete. During curing applications, return temperature should average 5° to 20°F (3° to 11°C) above concrete surface temperature.
4. Hydronic Heater Temperature: (HTF outlet temperature as displayed on the TC): Hydronic heater temperature will operate 60° to 80°F (33° to 44°C) greater than return temperature until reaching controller “set” temperature.
5. HTF Supply Pressure: Normal operating supply pressure should be 70 to 100 psig (483 to 689 kPa) with a maximum of 175 psig (1,200 kPa) during warm-up.
6. Plumbing and Fitting Leaks: Always check for leaks during each monitoring period.

## 2.5 UNIT SHUTDOWN

### 2.5.1 Burner Shutdown

Turn OFF the BURNER switch to allow system cool-down.

### 2.5.2 Rewinding the Heat Transfer Hose

1. Shut down both HTF pumps; verify that HTF pressure drops to zero by monitoring the HTF supply pressure gauges.
2. Remove the foot pedal from storage location and position to allow control of rewind operation. The foot pedal should be placed on a piece of plywood or other material to keep it dry. (Photo 2-7)
3. Turn ON the REWIND MOTOR switch. This will start the rewind motor and direct power to the rewind control foot pedal.
4. Release the hose reel brake by turning the brake knob counterclockwise.



**Always wear gloves to protect hands while rewinding HTH.**

5. Depress the foot pedal to begin rewinding, and guide the HTH evenly onto the reel.
6. Wind the first loop onto the hose reel and disconnect the QC from the supply plumbing. Disconnect the remaining hose loop from the return plumbing and connect it to the end of the hose loop on the hose reel. Continue with the hose rewinding process until the second hose loop is wound on the hose reel, do not disconnect the outer hose loop from the supply plumbing.



**Rewind the final 10 ft (3 m) of HTH by hand to prevent damaging a fitting or hose connection.**

7. Set the hose reel brake by turning the brake knob clockwise.

8. Turn OFF the REWIND MOTOR switch.
9. Return the foot pedal to storage location.

### 2.5.3 Completing Unit Shutdown

1. Shut the pump suction valve #2. Verify the fill valve #3 is locked shut with locking pin inserted.
2. Turn OFF both MAIN BREAKERS on the control panel. Disconnect the power cords.
3. Shut and lock both the side and rear doors.

**NOTE: Turn off optional Genset in accordance with Genset manufacturer's operating instructions, if so equipped.**

### 2.6 TEMPORARY UNIT SHUTDOWN

(To change Genset oil or during refueling)

1. Turn OFF the BURNER and PUMP switches.
2. Turn OFF both MAIN BREAKERS.
3. Turn off Genset and refuel Ground Heater or change oil in Genset (refer to Genset manufacturer's operator's manual).
4. Restart Genset (refer to Genset manufacturer's operator's manual).
5. Turn ON both MAIN BREAKERS.
6. Turn ON the BURNER, wait five seconds, turn ON PUMP 1 or PUMP 2, wait five seconds, then start the remaining PUMP.
7. Continue to monitor operating parameters per Section 2.4, MONITORING OPERATING PARAMETERS.

## TRANSPORTING THE S3000

This section describes the three basic methods of S3000 transport and associated precautions.

### 3.1 TOWING

The S3000 is easily towed by a vehicle rated to tow 7,000 lbs (3,175 kg) and fitted with a Class III or above hitch. (Photo 3-1)

The S3000 has a tongue weight from 460 to 1,000 lbs (208 to 454 kg), depending on fuel level and generator installation. Towing vehicle must be equipped with an electric brake system controller.

**NOTE:** A trailer plug wiring decal is located on the inside frame wall across from the connection box, and a wiring schematic is included in the connection box to assist matching towing vehicle setup.



### 3.2 CRANE and AIR LIFTING

The S3000 can be equipped with an optional lifting bale. The lifting bar's multiple holes accommodate various fuel loads and Genset options.



**A qualified rigger should set up and perform all rigging.**

### 3.3 TRANSPORTING on a FLATBED

The S3000 may be loaded onto a 98 in. (250 cm) or wider flatbed using common-sized loading ramps and docks. The S3000 should be chained down using the built-in tie-downs as shown. (Photo 3-2)





## MAINTENANCE

The S3000 must be operated only with Ground Heaters Heat Transfer Fluid (HTF). Non-compliance will void warranty. The standard S3000 includes 90 US gallons (341 liters) of HTF for normal operation. Ground Heaters, Inc. recommends that the HTF be replaced every three years to ensure that the corrosion inhibitors are sufficiently active to protect the system components.

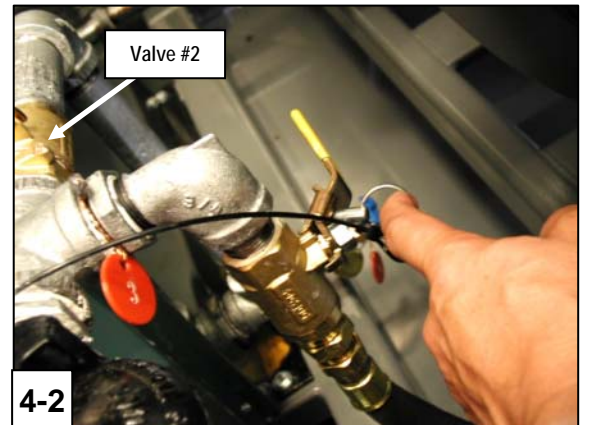
### 4.1 ADDING HEAT TRANSFER FLUID

#### 4.1.1 To Clear a LOW HTF LEVEL Condition

1. Power up the S3000 as directed in Steps 2.1.3 through 2.2.2.
2. Pull out the fill hose, wipe off dirt, and insert into a container of HTF. (Photo 4-1)
3. Verify pump suction valve #2 is shut.
4. Pull locking pin and open fill valve #3. (Photo 4-2)
5. Push in and hold the LOW LEVEL OVERRIDE button to start filling (photo 4-3), and release when level is visible in the expansion tank sight gauge. Push MANUAL RESET button on HTF low Level Shutdown device. (Photo 5-1, page 5-3)



**NOTE:** HTF Low Level Shutdown device green and red lights will blink for 15 seconds while device performs self-diagnostic tests. After 15 seconds the red light will go out and the green light will stay on, signaling the unit is ready to operate. The red LOW HTF LEVEL light on the control panel will also go out.



6. Turn PUMP 1 switch ON to continue filling, and turn OFF when level is between MIN and MAX in sight gauge. Shut and lock fill valve #3 using the locking pin. Stow the fill hose neatly under the hose reels or burner.
7. Proceed to Step 2.3.1 to continue unit start up, or turn OFF both MAIN BREAKERS to shut down.

#### 4.1.2 While Unit is Running

1. Pull out the fill hose, wipe off dirt, and insert into a container of HTF. (Photo 4-1)
2. Pull locking pin from fill valve #3. (Photo 4-2)
3. Simultaneously open valve #3 and shut suction valve #2.
4. When HTF level is between MIN and MAX, remove the fill hose from the HTF source, allow the hose to clear of excess HTF by lifting the open end above the level of the fill valve. Simultaneously open valve #2 and shut valve #3.
5. Using the locking pin, lock-shut valve #3. Neatly stow the fill hose under the hose reels or burner.



## 4.2 FILLING HEAT TRANSFER HOSE

Use the following procedure to fill empty HTH after it is connected to the machine and wound onto the hose reel.

**NOTE:** Each 1,500 ft (460 m) length of HTH will require approximately 27 gallons (102 liters) of HTF to fill.

- 4.2.1 Power-up the control panel as directed in Steps 2.1.3 through 2.2.2.
- 4.2.2 Pull out the fill hose, wipe off dirt, and insert into a container of HTF. (Photo 4-1)
- 4.2.3 Verify the pump suction valve #2 is shut. Pull locking pin and open fill valve #3. (Photo 4-2)
- 4.2.4 Push in and hold the LOW LEVEL OVERRIDE button to commence filling the HTH.

**NOTE:** If the LOW HTF LEVEL light is not on, operator may use the PUMP 1 switch instead of the LOW LEVEL OVERRIDE button. Do not run more than one pump at a time when both 1500 ft hose loops are connected together.

- 4.2.5 Release the LOW LEVEL OVERRIDE button (or turn OFF PUMP switch) when air bubbles cease to show in the return flow indicator and HTF level in the expansion tank rises to proper operating level.
- 4.2.6 Using the locking pin, lock-shut valve #3. Neatly stow the fill hose under the hose reels or burner.
- 4.2.7 Open pump suction valve #2. Turn ON PUMP 1 and circulate HTF through the newly filled HTH for approximately fifteen minutes. This will ensure all the air has been removed from the HTH.
- 4.2.8 If desired, shut down the S3000 as directed in Step 2.5.3.

## 4.3 BURNER COMBUSTION VERIFICATION AND ADJUSTMENT

**NOTE:** All Burners on Ground Heaters, Inc. equipment are initially calibrated by test firing at Ground Heaters, Inc.'s factory located 600 ft (180 m) above sea level (asl) using a 70/30% blend of #2 and #1 (K1) diesel with additives). If your Ground Heater will be operated on other fuels or at altitudes above 2,000 ft (610 m), you must recalibrate the Burner air/fuel ratio to obtain proper combustion.

To ensure proper Burner performance and to avoid machine downtime due to sooting, Burner combustion verification and adjustment must be performed:

- before operating at altitudes 1,000 ft (305 m) above or below the last adjustment.
- before starting at a new job site.
- after all Burner maintenance.
- after changing fuel type (winter blend to #2 Fuel Oil, etc.).
- if Burner performance is in question for any reason.

**NOTE:** The use of a high quality Combustion Analyzer and Fuel Pressure Test Gauge is mandatory. All adjustments must be accomplished by a licensed professional and must conform to the requirements of local, state and federal codes and authorities.

Use Air Band and Shutter settings along with fuel pressure adjustments to obtain an exhaust O<sub>2</sub> value of 3-4% and a smoke spot value of 1 or less. Maintaining O<sub>2</sub> in the 3-4% range assures that there are no unburned hydrocarbons remaining in the exhaust. Unburned hydrocarbons cause soot production. If the above values cannot be obtained by adjusting the Burner Air Band and Shutters alone, it may be necessary to reduce the firing rate (lower fuel pressure and/or install a smaller Burner Nozzle). This is especially true at altitudes above 3,000 ft (915 m).



#### 4.3.1 Start Burner

Start the Burner as directed in Step 2.3.2.

#### 4.3.2 Fuel Pressure Adjustment

(Refer to Appendix A-15.)

1. Disconnect the Fuel Line QCs from the Burner Fuel Pump.
2. Remove the ¼ in. Fuel Bleeder Port located on the lower front side of the Burner Fuel Pump.
3. Install an adapter to facilitate using a 0 to 300 psig Fuel Pressure Test Gauge. Do not use pipe dope.
4. Reconnect the Fuel Line QCs.
5. Turn the BURNER switch ON.
6. The Burner will begin a 15 second pre-purge. Monitor the fuel pressure after the pre-purge cycle is complete and the Fuel Shut-Off Valve opens. Make adjustments using the Fuel Pressure Adjusting Screw.
7. Turn the Fuel Pressure Adjusting Screw clockwise to increase fuel pressure or counterclockwise to decrease fuel pressure (refer to A-15, A-15a).
8. Once the fuel pressure is set, proceed with air setting and adjustment.

**NOTE:** High exhaust temperature can be caused by dirty heat transfer surfaces as well as excessive combustion air. Ensure Fire Tubes are clean and free of soot prior to adjusting air.

#### 4.3.3 Verify Burner Combustion Values

1. Turn the Combustion Analyzer ON and perform the purging and calibrating procedures given in Combustion Analyzer manufacturer's operating instructions.
2. Sample the Burner exhaust for O<sub>2</sub> percentage by inserting the Analyzer Probe into the Stack access hole provided through the Exhaust Guard. (Photo 4-4)
3. Exhaust O<sub>2</sub> should be 3-4% for optimum performance while minimizing smoke (soot) production. The higher the O<sub>2</sub>, the lower the amount of smoke; but higher O<sub>2</sub> lowers heater efficiency. With lower O<sub>2</sub>, the likelihood of smoke increases; but reduced O<sub>2</sub> raises heater efficiency by lowering exhaust temperature. It is recommended that the lowest possible O<sub>2</sub> levels be maintained while keeping smoke level below 1 (O<sub>2</sub> level of 4% maximum).
4. Exhaust temperature should be less than 500°F (260°C) when O<sub>2</sub> is in proper range at altitudes of 3,000 ft (915 m) asl and below.  
  
Burner adjustment for altitudes over 3,000 ft (915 m) asl may cause the exhaust temperature to exceed 500°F in some cases. This is a normal side effect. Begin to reduce fuel pressure if exhaust temperature exceeds 600°F (316°C).
5. Sample for smoke with a Smoke Spot Tester using the Stack access holes. A properly-maintained Hydronic Heater should be able to run with a smoke level of zero at 3-4%O<sub>2</sub>.

## MAINTENANCE

The S3000 must be operated only with Ground Heaters Heat Transfer Fluid (HTF). Non-compliance will void warranty. The standard S3000 includes 90 US gallons (341 liters) of HTF for normal operation. Ground Heaters, Inc. recommends that the HTF be replaced every three years to ensure that the corrosion inhibitors are sufficiently active to protect the system components.

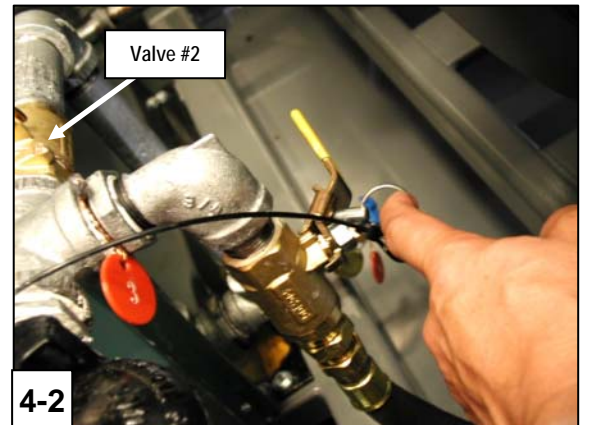
### 4.1 ADDING HEAT TRANSFER FLUID

#### 4.1.1 To Clear a LOW HTF LEVEL Condition

1. Power up the S3000 as directed in Steps 2.1.3 through 2.2.2.
2. Pull out the fill hose, wipe off dirt, and insert into a container of HTF. (Photo 4-1)
3. Verify pump suction valve #2 is shut.
4. Pull locking pin and open fill valve #3. (Photo 4-2)
5. Push in and hold the LOW LEVEL OVERRIDE button to start filling (photo 4-3), and release when level is visible in the expansion tank sight gauge. Push MANUAL RESET button on HTF low Level Shutdown device. (Photo 5-1, page 5-3)



**NOTE:** HTF Low Level Shutdown device green and red lights will blink for 15 seconds while device performs self-diagnostic tests. After 15 seconds the red light will go out and the green light will stay on, signaling the unit is ready to operate. The red LOW HTF LEVEL light on the control panel will also go out.



6. Turn PUMP 1 switch ON to continue filling, and turn OFF when level is between MIN and MAX in sight gauge. Shut and lock fill valve #3 using the locking pin. Stow the fill hose neatly under the hose reels or burner.
7. Proceed to Step 2.3.1 to continue unit start up, or turn OFF both MAIN BREAKERS to shut down.

#### 4.1.2 While Unit is Running

1. Pull out the fill hose, wipe off dirt, and insert into a container of HTF. (Photo 4-1)
2. Pull locking pin from fill valve #3. (Photo 4-2)
3. Simultaneously open valve #3 and shut suction valve #2.
4. When HTF level is between MIN and MAX, remove the fill hose from the HTF source, allow the hose to clear of excess HTF by lifting the open end above the level of the fill valve. Simultaneously open valve #2 and shut valve #3.
5. Using the locking pin, lock-shut valve #3. Neatly stow the fill hose under the hose reels or burner.





#### 4.5 RECOMMENDED FUELS

**NOTE:** Diesel fuel will thicken (jell) at low temperatures. Jelling (also known as waxing) may cause flame failure and/or fuel pump damage. Contact your local fuel supplier to obtain potential jelling temperatures for your fuel, as specifications for diesel fuel vary from terminal to terminal. Some fuel suppliers may add a fuel conditioner that absorbs moisture after jelling has occurred. Your fuel supplier should supply this information and make recommendations for the selection and use of such products. If ambient temperatures are such that your fuel supplier cannot insure the fuel will not jell, K1 Kerosene or #1 diesel fuel (dyed K1 for off road use) must be added by ratio until jelling does not occur.



Ground Heaters, Inc. recommends adding cetane booster to your diesel fuel. Follow the manufacturer's recommendations for amounts.



If your Ground Heater is equipped with a Genset, consult the Genset manufacturer's operating instructions or call the Genset manufacturer to determine the amount of #2 diesel fuel by ratio required for proper lubrication of the engine.

##### 4.5.1 Diesel, Winter Blend (off road)

Winter Blend Diesel (#2 Diesel and #1 Diesel mixture) is recommended for Ground Heater operation during ambient temperatures where jelling may occur. Consult the Fuel Blend Guide, above, and contact your fueling supplier for this fuel specification.

##### 4.5.2 #2 Diesel (non-winter applications)

The S3000 will operate well using #2 fuels during ambient temperatures of 30°F (-1°C) or greater, as long as the burner air settings are adjusted accordingly.

##### 4.5.3 K-1 Kerosene

Add K-1 at 30% by volume.

##### 4.5.4 All Ground Heater burner air intakes are initially calibrated (adjusted) by test firing at Ground Heaters, Inc.'s factory located 600 ft (180 m) asl, using Winter Blend Diesel.

**NOTE:** If your Ground Heater will be operated on other fuels or at elevations above 2,000 ft (610 m), you must recalibrate the burner air settings to obtain proper combustion. A Combustion Analyzer and a Smoke True Spot Tester will be required. Refer to Section 4.3, BURNER COMBUSTION EFFICIENCY VERIFICATION AND ADJUSTMENT, for complete instructions.

#### 4.6 DRAINING HYDRONIC HEATER AND EXPANSION TANK FOR MAINTENANCE

**NOTE:** Ensure HTF storage container(s)' capacity is capable of holding at least 40 gallons (not including hose loops).

- 4.6.1 Pull out the fill hose, wipe off dirt, and insert into a suitable container with level low enough to allow gravity draining.
- 4.6.2 Pull the locking pin and open fill valve #3.
- 4.6.3 Drain the system to the desired level by opening and shutting pump suction valve #2.
- 4.6.4 Using the locking pin, lock-shut valve #3.
- 4.6.5 Stow the fill hose neatly under the hose reels or burner.

#### 4.7 RECOVERING HEAT TRANSFER FLUID FROM HEAT TRANSFER HOSE

**NOTE:** S3000 is shut down and control panel has electric power available.

- 4.7.1 Pull out the fill hose, wipe off dirt, and insert into a clean, empty container capable of holding at least 55 gallons of HTF.
- 4.7.2 Turn ON both MAIN BREAKERS.
- 4.7.3 OPEN pump suction valve #2. Pull locking pin from fill valve #3. Open valve #3 to drain system until the expansion tank sight gauge is empty of HTF, then shut valve #3.
- 4.7.4 Shut valve #2 and open hose reel supply valve #4.

**NOTE:** Do not empty HTF from HTH into the expansion tank. The expansion tank does not have sufficient volume for storing fluid recovered from HTH.

- 4.7.5 Connect a service air hose (100 psig [700 kPa] maximum pressure) to the air quick-connect fitting in the supply plumbing. (Photo 4-7)
- 4.7.6 Slowly open the air connection valve and monitor for flow.
- 4.7.7 Monitor the fluid level in the expansion tank. Periodically drain HTF by opening the fill valve #3 as the expansion tank fills. Do not allow HTF levels to exceed the visible range in the expansion tank sight glass.
- 4.7.8 Shut the air connection valve when air bubbles appear in the return flow indicator or air is heard flowing into the expansion tank.
- 4.7.9 Disconnect emptied hose.
- 4.7.10 Restore expansion tank HTF level to normal using Steps 4.3.1 to 4.3.3 or Section 4.2, FILLING HEAT TRANSFER HOSE, as applicable.



#### 4.8 CLEANING HTF PUMP SUCTION STRAINER

**NOTE:** Removing all particulates from HTF may require two to three cleaning cycles. Filter the system for up to one hour, then remove the strainer basket for cleaning. Repeat this process until the strainer basket has no particulates build-up.

##### 4.8.1 Empty Suction Plumbing

1. Power up the control panel as directed in Steps 2.1.3 through 2.2.2.
2. Verify pump suction valve #2 is shut.
3. Pull out fill valve locking pin and open fill valve #3.
4. Push in and hold the LOW LEVEL OVERRIDE button until air appears in the return flow indicator. This will substantially empty the strainer housing and adjacent plumbing. Shut valve #3.
5. Turn OFF both MAIN BREAKERS.

##### 4.8.2 Strainer Disassembly

1. Place a plastic bag, or other suitable container, under the strainer to catch any spillage.
2. Using a  $\frac{5}{8}$  in. socket or wrench, loosen the top center bolt. (Photo 4-8)
3. Lower strainer housing and move to work area.

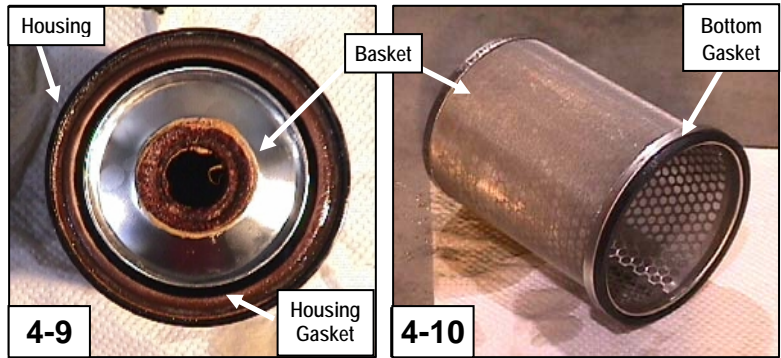


#### 4.8.3 Strainer Assembly

1. Replace any damaged components and reinsert basket into housing.
2. Reassemble and tighten using  $\frac{5}{8}$  in. socket or wrench on top bolt and  $\frac{1}{2}$  in. socket on bottom nut.

4.8.4 Carefully pull strainer basket from housing. Rinse off trapped debris from strainer screen with warm water. (Photo 4-9)

4.8.5 Inspect screen, bottom rubber gasket and housing gasket for damage. Replace any damaged gaskets. (Photo 4-10)



### 4.9 SUMMER STORAGE INSTRUCTIONS

- 4.9.1 It is recommended that the fuel tank be completely filled with stabilized fuel. Operate the burner for at least 15 minutes to ensure that the stabilized fuel has been circulated through the fuel system. Any known brand of fuel stabilizer for fuel oil and/or diesel is acceptable.
- 4.9.2 Allow the heater to cool sufficiently. Cover the chimney and the burner with plastic wrap or other waterproof material. This will prevent corrosive moisture build-up and blockages caused by animal nests.
- 4.9.3 Remove emergency break-away battery and store the battery in a cool, dry place. Connect the battery to a trickle charger once every 30 days to maintain full charge. (This includes the Genset battery on Ground Heaters, if so equipped.)
- 4.9.4 Perform a thorough inspection for leaks, and correct. Double-check that all valves are shut.
- 4.9.5 Shut and lock all doors.
- 4.9.6 Protect the tires from direct sunlight if stored outdoors.

**NOTE: Do not drain the HTF. The heater and plumbing must remain flooded with HTF to prevent corrosion (rusting).**

### 4.10 PRE-SEASON MAINTENANCE

(Refer to Section 3 of the Service Manual for detailed instructions)

- 4.10.1 Remove all waterproof wrapping or covering from the chimney and burner.
- 4.10.2 Test and reinstall emergency break-away battery.
- 4.10.3 Remove flue door. Inspect fire tubes and turbulators (baffles). Clean out any soot or flaked material. Replace turbulators damaged by heavy corrosion. Remount flue door.
- 4.10.4 Remove the burner electrode assembly. Replace the nozzle with an exact replacement. Adjust or replace the electrodes as necessary.
- 4.10.5 Remove the burner to inspect and clean the flame head.
- 4.10.6 Replace fuel filter element.
- 4.10.7 Reinstall the electrode assembly and verify the "Z" distance is correctly set.
- 4.10.8 Remount burner using a new burner mounting gasket.
- 4.10.9 Connect a pressure gauge to the pressure testing port of the fuel pump. Start the burner and verify fuel pressure set to 140 psi.

## MAINTENANCE

The S3000 must be operated only with Ground Heaters Heat Transfer Fluid (HTF). Non-compliance will void warranty. The standard S3000 includes 90 US gallons (341 liters) of HTF for normal operation. Ground Heaters, Inc. recommends that the HTF be replaced every three years to ensure that the corrosion inhibitors are sufficiently active to protect the system components.

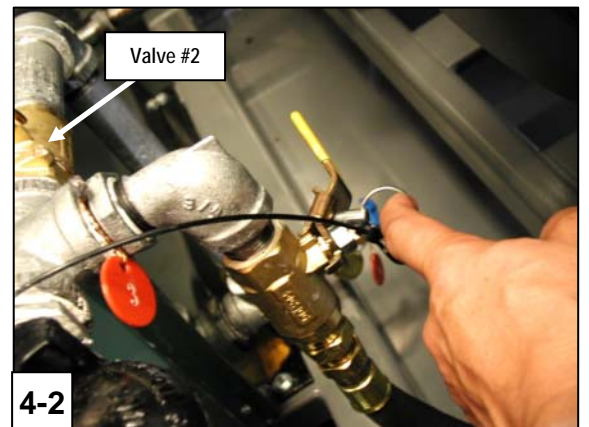
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4. Pull locking pin and open fill valve #3. (Photo 4-2)
5. Push in and hold the LOW LEVEL OVERRIDE button to start filling (photo 4-3), and release when level is visible in the expansion tank sight gauge. Push MANUAL RESET button on HTF low Level Shutdown device. (Photo 5-1, page 5-3)



**NOTE:** HTF Low Level Shutdown device green and red lights will blink for 15 seconds while device performs self-diagnostic tests. After 15 seconds the red light will go out and the green light will stay on, signaling the unit is ready to operate. The red LOW HTF LEVEL light on the control panel will also go out.



6. Turn PUMP 1 switch ON to continue filling, and turn OFF when level is between MIN and MAX in sight gauge. Shut and lock fill valve #3 using the locking pin. Stow the fill hose neatly under the hose reels or burner.
7. Proceed to Step 2.3.1 to continue unit start up, or turn OFF both MAIN BREAKERS to shut down.

#### 4.1.2 While Unit is Running

1. Pull out the fill hose, wipe off dirt, and insert into a container of HTF. (Photo 4-1)
2. Pull locking pin from fill valve #3. (Photo 4-2)
3. Simultaneously open valve #3 and shut suction valve #2.
4. When HTF level is between MIN and MAX, remove the fill hose from the HTF source, allow the hose to clear of excess HTF by lifting the open end above the level of the fill valve. Simultaneously open valve #2 and shut valve #3.
5. Using the locking pin, lock-shut valve #3. Neatly stow the fill hose under the hose reels or burner.



## TROUBLESHOOTING

Contact your local Ground Heaters Distributor for situations not covered in this section.

**NOTE:** Discontinue troubleshooting activities and shut down the S3000 if one of the following occurs:

- One of the GFIs trip and will not remain reset.
- A MAIN BREAKER or the burner motor overload reset button on the burner motor will not remain reset. (Discontinue efforts to reset these devices after two unsuccessful attempts.)
- An electric motor "hums" but does not turn.
- The Burner Safety will not reset by pushing MANUAL RESET button momentarily.
- Dark smoke emits from the hydronic heater exhaust.

Once the S3000 is shut down, call your local Ground Heaters Distributor for assistance.

TROUBLESHOOTING CHART			
Symptom	Possible Cause	Corrective Action	Refer To
Thaw progress below expectations	Insufficient insulation	- Verify proper blanket overlap - Add additional layer(s) of blankets	-----
	No vapor barrier	- Lay down vapor barrier	-----
	Insufficient moisture	- Add moisture	-----
	Temperature Controller not set at 180°F (82°C)	- Set Temperature Controller to 180°F (82°C)	Step 2.3.2.1
	Soil type not as expected	- Adjust thaw plan	-----
Heat Transfer Fluid pump will not start	No power due to incorrect switch position or protective function action	- Verify <u>both</u> MAIN BREAKERS are ON - Verify <u>both</u> GFIs are reset - Verify HTF level is between MIN and MAX LEVEL and LOW HTF LEVEL light is <u>not</u> lit - Verify Low Level Shutdown is RESET	Step 2.2.2  Step 2.2.1  Photo 5-1
	Motor internal overload is tripped	- Allow motor to cool; it will reset automatically - Have an electrician verify voltage at control panel is 110 volts (min.) while attempting to start pump motor	-----
Heat Transfer Fluid pump(s) has high noise level and low fluid output.	Suction valve not fully open	- Verify pump suction valve #2 is fully open	-----
	Suction filter is clogged – evident by collapsed pump suction hose	- Clean filter basket	Section 4.8

TROUBLESHOOTING CHART (continued)			
Symptom	Possible Cause	Corrective Action	Refer To
Burner motor will not start	Insufficient power supply	<ul style="list-style-type: none"> <li>- Have an electrician verify voltage at control panel is 110 volts (min.) during burner start up</li> <li>- Ensure power cords are at least 10-3 wire and ≤ 100 ft (30 m) long</li> <li>- Verify power cords are supplied by separate 20 amp. circuits</li> </ul>	-----
	Power supply sufficient, but no power to burner motor.	- Call your Ground Heaters Distributor	-----
	Improper switch position or protective function action	<ul style="list-style-type: none"> <li>- Verify <u>both</u> MAIN BREAKERS are ON</li> <li>- Verify <u>both</u> GFIs are reset</li> <li>- Verify HTF level is between MIN and MAX level and the LOW HTF LEVEL light is <u>not</u> lit</li> <li>- Verify Low Level Shutdown is RESET</li> </ul>	Step 2.2.2 Step 2.2.2.1 Step 2.1.2.4 Photo 5-1
	Burner Safety is tripped	- Reset Burner Safety	Photos 5-2 and 5-3
Burner safety trips (no flame)	No fuel	<ul style="list-style-type: none"> <li>- Verify fuel tank level is greater than 1/8 full</li> <li>- Verify <u>both</u> fuel line quick-connects are connected</li> </ul>	Step 2.1.2.2 Step 2.1.2.3
	Insufficient voltage for ignition	<ul style="list-style-type: none"> <li>- Have an electrician verify voltage at control panel is 110 volts (min.) during burner start up</li> <li>- Ensure power cord is at least 10-3 wire and ≤ 100 ft (30 m) long</li> <li>- Verify power cords are supplied by separate 20 amp. circuits</li> </ul>	-----
Burner safety trips (flame occurs)	Controller not sensing flame	- Call your Ground Heaters Distributor	-----
Hoses will not rewind	Brake not fully released	- Fully release hose reel brake	Step 2.3.4.1
	Rewind motor is too cold (rewind motor may not start if below 0°F [-18°C])	<ul style="list-style-type: none"> <li>- Run the S3000 with the doors shut until interior temperature has warmed the rewind motor</li> <li>- Warm rewind motor by other means</li> </ul>	-----
	Faulty foot pedal	- Call your Ground Heaters Distributor	-----

If problem is not resolved by performing the above steps, call your Ground Heaters Distributor for assistance.

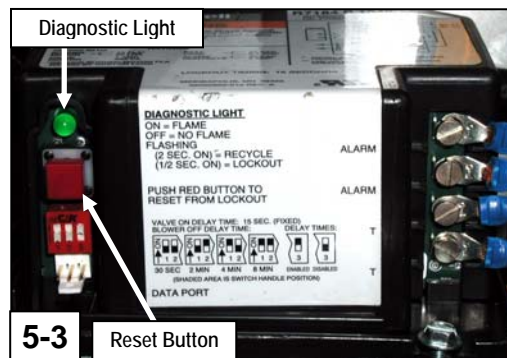
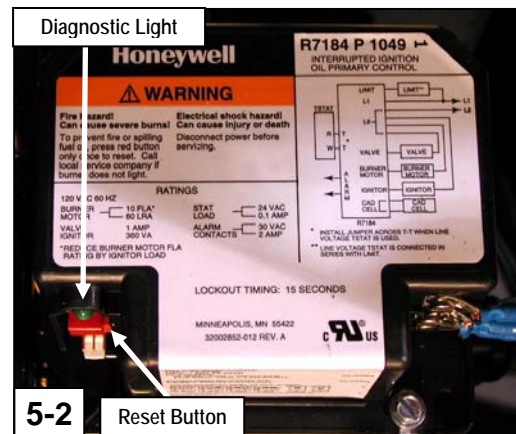


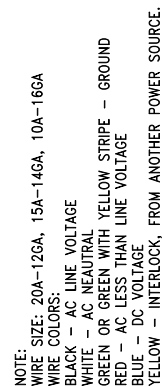
Perform the following when LOW HTF LEVEL (Control Panel) and LOW WATER (Low Level Shutdown) lights are lit:

- Turn BURNER, PUMP 1, PUMP 2, and REWIND MOTOR switches OFF.
- Locate and correct cause of low HTF condition (i.e. fix the leak).
- Restore HTF level to normal operating level per Section 4.1, ADDING HEAT TRANSFER FLUID.
- Depress MANUAL RESET button to clear LOW LEVEL condition. (Photo 5-1) Reset will complete in 15 seconds.

**NOTE:** Call your Ground Heaters Distributor if either of the following is true:

- HTF level is between MIN and MAX and LOW WATER condition will not clear (reset).
- LOW HTF LEVEL and LOW WATER lights do not agree (both must be off or both must be on).





REV.	BY	DESCRIPTION	DATE
-	-	See Sheet 1	-

# Ground Inc. Heaters

1271 Jackson Road  
Spring Lake, MI 49456  
Tel: 231.799.9600 Fax: 231.799.9600

SIZE	QUANTITY	ORDER NO.	DRB
B	A110-002		
SCALE	1:1	SHEET 06/17/03 SHEET 5 OF 5	

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## SPECIFICATIONS

Dimensions and Capacities	Without Generator	With Generator
Length	171 in. (434 cm)	171 in. (434 cm)
Width	79 in. (201 cm)	79 in. (201 cm)
Height	85 in. (216 cm)	85 in. (216 cm)
Weight (without fuel)	5,340 lbs (2,422 kg)	5,740 lbs (2,603 kg)
Weight (with fuel)	6,585 lbs (2,986 kg)	6,985 lbs (3,168 kg)
Gross Vehicle Weight Rating (GVWR)	7,139 lbs (3,241 kg)	
Fuel Capacity	178 US gallons (674 liters)	
Fuel (recommended) (See Section 4)	Diesel (winter blend)	
Heat Transfer Fluid	90 US gallons (341 liters)	
Heat Transfer Hose	3,000 ft [2 x 1,500 ft] (915 m [2 x 457 m])	
Hose Reels	1	
Circulation Loops	2	

Performance	
Gross Heat Input from Fuel	280,000 BTU/H
Net Heat Output	240,000 BTU/H
Fuel Consumption (Burner On)	2.0 US gph (7.6 liters per hour)
Fuel Consumption (Genset and Burner On)	2.4 US gph (9.1 liters per hour)
Run Time	140 to 90 hours
Normal Operating Temperature	160° to 180°F (71° to 82°C)
Normal Hose Pressure	70 to 100 psig (483 to 689 kPa)
Pump, Fixed Displacement	2 @ 265 US gph
Thawing Capacity	up to 4,500 ft <sup>2</sup> * (418 m <sup>2</sup> *)
Curing/Heating Capacity	up to 6,000 ft <sup>2</sup> * (557 m <sup>2</sup> *)
Air Heating Capacity	up to 12,000 ft <sup>2</sup> (1,115 m <sup>2</sup> )

\*Maximum capacities reached using optional accessories.

See Appendix A-5.







